

## **5.0 ENVIRONMENTAL IMPACTS**

The following sections describe potential impacts from the proposed action.

### **5.1 MODIFICATION AND OPERATION IMPACTS**

Impacts from the modification and operation activities are described in the following sections.

#### **5.1.1 Soil or Subsurface Disturbance**

All soil disturbances would occur on previously disturbed soil within the 218-W-4B and 218-W-4C LLBG. All soil and subsurface activities would be temporary. Therefore, the anticipated impacts to the environment are not expected to be consequential.

#### **5.1.2 Liquid Discharges to the Groundwater or Surface Waters**

TRU waste retrieval activities might include application of clean water or fixatives for fugitive dust control. However, because the water table is more than 75 meters (240 feet) below the surface, this activity would have little effect on groundwater or surface waters. Standard LLBG operational run-on/run-off controls would be used.

#### **5.1.3 Gaseous, Particulate, or Thermal Discharges to the Air**

Small quantities of gaseous and particulate discharges might occur from typical excavation activities in the LLBG. Other than some vehicle or crane exhausts, thermal discharges would not be expected. Sources could include the disturbance of contaminated soil, releases from the unearthing of contaminated or breached containers, installation of HEPA filtered venting devices, and very minor releases from the vented containers through the HEPA filtered devices.

Under the proposed action, all air effluents would be diffuse and fugitive. Monitoring for diffuse and fugitive emissions is conducted through the Near-Facility Environmental Monitoring Program.

Only very minor radiological and hazardous substance releases are expected during excavation, venting operations, and from the vented containers. Any unexpected releases would come from breached drums. The number of breached drums is expected to be very low. Under conditions that would be in effect, no substantial increases in overall emissions are envisioned from the proposed action.

#### **5.1.4 Radiation Exposure**

Any retrieval work in the LLBG would be performed in compliance with as low as reasonably achievable (ALARA) principles, applicable federal and state regulations, and DOE Orders and guidelines. The LLBG are monitored routinely for radiation levels, and radiation work permits would specify the radiological condition and any entry requirements. Personnel would be required to have appropriate training, wear appropriate personal protective equipment, adhere to ALARA principles, and follow established administrative controls. Localized areas of potential radionuclide contamination would be

cleaned up, packaged, and disposed of, however the proposed action would not remediate large areas of the LLBG. Radionuclide contamination releases, if any, are expected to be extremely small. Because potential internal deposition would be expected to be extremely small, inhalation doses were not included or calculated in the dose estimates.

Personnel radiation protection during both LLBG modifications and retrieval activities would be provided through the use of procedural controls and engineering controls as appropriate. Potential radiological exposure received by personnel during the proposed action would be similar to exposures that occur during current routine LLBG operation activities. Radiation exposures would be controlled administratively below DOE limits established in 10 CFR 835, "Occupational Radiation Protection" and the *Project Hanford Radiological Control Manual* (HNF-5173).

Based on existing information contained in WHC-EP-0225, *Contact-Handled Transuranic Waste Characterization Based On Existing Records*, a dose estimate was calculated for the proposed action. Since the time the documents were released some of the waste containers have been moved between trenches or moved from the LLBG to another TSD unit, but no additional TRU waste has been moved into those trenches. Based on existing information, bounding dose conditions have been calculated. This information was used for the bounding inventory values in the safety analysis.

The inventory presented above was consolidated and grouped into distinct dose rate categories (Table 1) based on information contained in WHC-EP-0225. Once the inventory was grouped into the dose rate categories, a statistical analysis was performed to determine the percentage of packages in each category. A dose rate was estimated and assigned for each category. The following assumptions and information were used in order to estimate the total dose to an individual worker and cumulative dose that would be expected.

Based on the number of years (approximately thirty years) that have elapsed since the start of placement of TRU waste and considering the isotopic distribution and the dose rate information stated in WHC-EP-0225, it was assumed that the dose rates would be half the reported value because of radioactive decay. In addition, it was assumed that the exposure would be received at a distance of 2 feet from the source term (a factor of 4 reduction in the contact exposure rate). These data were applied to the life cycle of the retrieval project (currently 5 years).

To estimate the dose received during the project, occupancy factors were applied to the amount of time personnel would be in the dose rate categories listed in Table 1. The amount of time an individual would be in the estimated dose rates was 40% of an occupational year (i.e., 2000 hours per year with a 40% occupancy rate indicates that the annual exposure time in the referenced dose rate would be 800 hours per year or 4000 hours for the project). To determine the cumulative dose shown in Table 1, three workers were assumed to be involved in the retrieval activities and receive exposure from the source term at the calculated rate over the life of the proposed action.

Table1. Potential Radiological Doses per Dose Rate Category.

Dose rate category (mrem/hr)	Percentage of packages in category	Dose Rate during retrieval operations (mrem/hr)	Individual estimated total dose received (mrem)	Cumulative dose (person-mrem)
< 5	91.4	0.1	366	1,097
5 to 10	5.1	0.9	182	546
10 to 20	1.0	1.9	75	226
20 to 50	1.0	4.5	179	538
50 to 100	0.6	9.5	220	661
100 to 150	0.2	15.8	141	422
150 to 250	0.3	22	259	776
Greater than 250	0.4	31.3	557	1,671

mrem/hr = millirem per hour

Based on these estimates, the projected total cumulative dose for the TRU retrieval project has been calculated to be approximately 5.9 person-rem over the 5 year period for the proposed action.

Because the proposed action would involve only extremely small radionuclide releases and low direct radiation exposure during LLBG modifications and retrieval activities, these impacts to the environment would be expected to be small.

### 5.1.5 Nonhazardous Solid Waste Generated

It is expected that only small amounts of nonhazardous solid waste would be generated during the proposed action. The addition of nonhazardous waste from the proposed action into an onsite landfill would be small compared to the expected overall waste disposal capacity on the Hanford Site. In addition, other facilities would be expected to have adequate capacity to accept all other waste volumes from the proposed action. All nonhazardous waste would be disposed of in accordance with applicable requirements. Therefore, these impacts to the environment would be expected to be small.

### 5.1.6 Hazardous, Dangerous, or Radioactive Waste Generated

Small amounts of potential hazardous/dangerous/radioactive waste might be generated during operation. This waste, if generated, would be managed and disposed of in accordance with applicable federal and state regulations. Waste that might be generated from the proposed action would be expected to be minimal compared to annual Hanford Site waste generation. Therefore, these impacts to the environment would not be expected to be consequential.

### 5.1.7 Hazardous Substances Present

Table 2 presents the possible hazardous substances present in a small number of the drums to be retrieved under the proposed action.

Table 2. Potential Hazardous  
Substances in Small Number of Drums.

Ammonia
Beryllium
Cadmium
Cyclohexane
Dioxane
Hydrogen Peroxide
Indole-2-C-14 picrate
Manganese
Mercury
Naphthylamine tritium
Nitric Acid
Phosphoric acid
Propane
Sodium
Sodium Hydroxide
Sodium hypochlorite
Sodium oxalate
Styrene
Tetrahydrofuran
Uranyl nitrate hexahydrate
Vinyl ester/ acetate resins
Vinyl chloride/ resins
Zirconium

During normal retrieval operations, personnel would not be expected to be exposed to these hazardous substances.

#### **5.1.8 Disturbance to Previously Undeveloped Areas**

All areas within the proposed action are previously disturbed areas.

#### **5.1.9 Consumption or Commitment of Nonrenewable Resources**

Consumption of nonrenewable resources (e.g., fuel, wiring, venting devices) would occur. None of the materials to be used are in short supply. The amount of consumption would be minimal and managed through established procedures.

#### **5.1.10 Effects on Federal or State Listed, Proposed or Candidate, Threatened or Endangered Species**

No federal or state-listed, proposed, candidate, threatened, or endangered species are expected to be affected, because the proposed action would occur within the previously disturbed LLBG and the biological review, ECR #2001-200-064 (Appendix A) did not identify any affected species.

### **5.1.11 Effects on Cultural Resources**

A Hanford Cultural Resources Review, HCRC #2001-200-064 (Appendix B), was conducted for the proposed action. The review concluded that: "No historic properties are affected by this undertaking". In addition, the State archaeologist concurred "...that no cultural resources are in the identified area of potential effect" (Appendix B). Workers would be directed to watch for cultural materials (e.g., bones, artifacts) during all work activities. If any are encountered, work in the vicinity of the discovery would stop until an archaeologist has made an assessment. Therefore, no adverse impacts under the *National Historic Preservation Act of 1966* are expected.

### **5.1.12 Effects on any Floodplain or Wetland**

The retrieval activities would not occur in a 100- or 500-year floodplain, nor within any area designated as a wetland.

### **5.1.13 Effects on any Wild and Scenic River, State or Federal Wildlife Refuge, or Specially Designated Area**

The proposed action is outside any Wild and Scenic River corridor, state or federal wildlife refuge, or specially-designated area.

### **5.1.14 Reasonably Foreseeable Accidents Considered and the Potential Effects**

The term 'reasonably foreseeable accident' does not imply that the accident is likely to occur. It does suggest that the accident has a frequency of occurrence of greater than one in a million.

#### **Modifications Phase**

The reasonably foreseeable accidents during the minor LLBG modifications would be typical construction accidents. Nonradiological risks to personnel from occupational illness or injury were based on statistics for DOE and DOE contractor experience (DOE 2000). The lost work-day rate is 63 per 200,000 hours of construction work. The fatality rate is close to zero per 200,000 hours of work. About 1 lost work day and no fatalities would be expected during the retrieval phase. All LLBG modification personnel would follow approved LLBG safety procedures for modification activities. There have been no lost workdays in the LLBG over the last 2 years. Public health and safety would not be affected because the area is closed to the general public. Typical construction hazards would exist during the LLBG modifications; however, the risk of severe accidents would be small.

#### **Retrieval Phase**

During retrieval of waste containers under the proposed action, operations would be similar to the current uncovered TRU waste drum removal activities in the LLBG, which are conducted under a DOE-approved LLBG safety authorization basis and in conformance with recognized safety codes, regulations, and approved procedures. Administrative controls would be used to reduce the chance of accidents.

The preliminary hazard evaluation for the retrieval of TRU from the LLBG has been performed. A fire and explosion involving retrieved containers was postulated as the bounding accident scenario because of potential mixing of incompatible materials, unvented hydrogen buildup, or the ignition of propane from discarded cylinders. Hazardous materials might be present in waste to be retrieved. Among the waste contents were incompatible materials that could interact, discarded propane cylinders, and materials causing the potential for hydrogen buildup. These conditions could lead to the explosion of a container. The frequency of the event was judged to be in the extremely unlikely ( $<10^{-4}$   $>10^{-6}$ ) event frequency category.

A handling accident resulting in an explosion would be initiated in the same manner as a mechanical release. A drum picker (modified forklift) could puncture drums while attempting to grab a drum, or could cause drums to fall from elevated positions through unintended contact, through a rapid stop, or through a rapid start. A number of the drums removed from the modules might not be vented; unvented drums could have hydrogen-oxygen mixes that might ignite on dropping of the drum, if the impact caused an internal spark. If incompatible materials were present (initially in separate containers, probably 1-liter plastic jars but possibly glass) in a drum that was punctured or dropped, breaking or spilling the separate containers could occur from the damage induced by the accident, mixing of incompatible materials or ignition of hydrogen gas could occur, and an explosion could result. A puncture of a drum by equipment would rupture the drum and could damage multiple containers or a propane cylinder. The piercing by the drum picker also could provide the spark to ignite the propane or hydrogen gas.

The scenario for the bounding accident not only involved the drum that exploded, but also postulated that 29 other containers could be involved in the accident. It was postulated that the fire resulting from the exploded drum ignited the exposed material from the other containers. The source term for the drums involved in an explosion accident would involve a drum containing 494 grams TRU, and the subsequent rupture and burning release of the contents of 29 containers with 200 grams of TRU each.

The dropping of a container resulting in an explosion in one drum and a fire in other drums could occur because of either a mechanical failure or an operator error. The risk associated with the accident was determined by comparing the consequences and frequency of the event to the risk evaluation guidelines based on SEN-35-91, *DOE Nuclear Safety Policy*. Comparison of the event consequences to the evaluation guidelines is documented in Table 3. The unmitigated onsite and offsite dose consequences for a multiple TRU container explosion accident were less than the evaluation criterion. The doses also were below the emergency preparedness action guide of 1 rem offsite (conservatively taken to be the river boundary).

Table 3. Comparison of Maximum Exposed Individual Doses to Risk Guidelines.

Receptor location	Projected dose (rem)	Guideline (rem)
Nearest facility	84	100.0
Closest river shore	0.53	1.0
Site boundary	0.42	1 to 25.0

To provide perspective on the anticipated health effects associated with projected accident doses of the magnitude presented in Table 3 above, the occupational dose risk factor of  $4 \times 10^{-4}$  fatal cancers per person-rem and the public dose risk factor of  $5 \times 10^{-4}$  fatal cancers per person-rem are used to project potential effects. Maximally exposed individuals, if they actually received doses of the magnitude shown in Table 3, would have an estimated 3.4 % increase in probability of radiation-induced cancer for a worker

at the nearest facility not involved in the accident, an estimated 0.026% increase in probability of radiation-induced cancer for a member of the public located on the nearest river shore, or an estimated 0.021% increase in probability of radiation-induced cancer for a member of the public located at the site boundary. It is most likely that there would be no incidents of fatal cancer attributable to projected accident exposures of the magnitude shown in the table.

Any of the accident sequences analyzed have the potential to release toxic material as well as radioactive material. The toxic consequences of a release from a drum in a fire were compared to the temporary emergency exposure limits (TEELs) as established by the U.S. Department of Energy, Subcommittee on Consequence Assessment and Protective Actions (WSMS-SAE-99-0001 2000), as this scenario has a potential high release fraction.

The potential hazardous chemical concentrations are shown in Table 4 for the worst case inventories. A comparison of chemical concentrations to TEELs for the bounding accident is shown. TEEL-1 is the maximum concentration in the air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient health effects or perceiving a clearly defined objectionable odor. TEEL-2 is the maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. It is unreasonable to assume that the maximum concentrations for several different chemicals are in the same drum, per WHC-EP-0225.

Table 4. Comparison of Chemical Concentrations to Temporary Emergency Exposure Limits for Bounding Accident.

Chemical	Maximum amount in a drum (kg)	Concentration at Nearest Facility (mg/m <sup>3</sup> )	TEEL 2 (mg/m <sup>3</sup> )	Ratio of Concentration at the Near Facility To TEEL 2	Concentration at site boundary (mg/m <sup>3</sup> )	TEEL 1 (mg/m <sup>3</sup> )	Ratio of Concentration at the Near River To TEEL 1
Ammonia	0.45	3.45 E-04	140	2.47 E-06	6.21 E-07	18	3.45 E-08
Beryllium	7	5.37 E-03	0.025	2.15 E-01	9.66 E-06	0.005	1.93 E-03
Cadmium	89.99	6.90 E-02	4	1.73 E-02	1.24 E-04	0.03	4.14 E-03
Cyclohexane	3.75	2.88 E-03	4,500	6.39 E-07	5.18 E-06	3,100	1.67 E-09
Dioxane	25.22	1.93 E-02	450	4.30 E-05	3.48 E-05	270	1.29 E-07
Hydrogen peroxide	0.49	3.83 E-04	70	5.48 E-06	6.90 E-07	14	4.93 E-08
Indole-2-c24 picrate	0.0001	7.67 E-08	0.5	1.53 E-07	1.38 E-10	0.3	4.60 E-10
Manganese	0.06	4.60 E-05	5	9.21 E-06	8.28 E-08	3	2.76 E-08
Mercury	43.55	3.34 E-02	0.1	3.34 E-01	6.01 E-05	0.1	6.01 E-04
Napthylamine tritium	102.06	7.83 E-02	260	3.01 E-04	1.41 E-04	35	4.03 E-06
Nitric acid	34.99	2.68 E-02	13	2.07 E-03	4.83 E-05	2.6	1.86 E-05
Phosphoric acid	49.98	3.83 E-02	5	7.67 E-03	6.90 E-04	3	2.30 E-05
Propane	0.89	6.90 E-04	3,800	1.82 E-07	1.24 E-06	3,800	3.27 E-10
Sodium	2.56	1.96 E-03	500	3.93 E-06	3.53 E-06	150	2.36 E-08
Sodium hydroxide	37.19	2.85 E-02	5	5.71 E-03	5.13 E-05	0.5	1.03 E-04
Sodium hypochlorite	0.0075	5.75 E-06	500	1.15 E-08	1.04 E-08	75	1.38 E-10
Sodium oxalate	48.26	3.70 E-02	50	7.40 E-04	6.66 E-05	30	2.22 E-06
Styrene	2.75	2.11 E-03	1,100	1.92 E-06	3.80 E-06	210	1.81 E-08
Tetrahydrofuran	1.35	1.04 E-03	3,000	3.45 E-07	1.86 E-06	740	2.52 E-09
Uranyl nitrate hexahydrate	6.11	4.69 E-03	0.6	7.81 E-03	8.44 E-06	0.6	1.41 E-05
Vinyl ester/acetate	2.75	2.11 E-03	500	4.22 E-06	3.80 E-06	100	3.80 E-08
Vinyl chloride	4.09	3.14 E-03	13	2.42 E-04	5.65 E-05	13	4.35 E-07
Zirconium	0.86	6.60 E-04	10	6.60 E-05	1.19 E-06	10	1.19 E-07

kg = kilogram

mg/m<sup>3</sup> = milligram per cubic meter.

Table 4 shows that even under worst-case inventories for potential hazardous materials in drums under the bounding accident scenario, that TEEL limits would not be exceeded.

## 5.2 SOCIOECONOMIC IMPACTS

A temporary contractor most likely would be hired to run the assay and venting equipment/operations. However, most of the proposed TRU waste retrieval activities would involve existing operating personnel at LLBG, so no long-term additional personnel would be needed. In a local population of over 165,000 persons with a workforce in excess of 8,000 persons on the Hanford Site, the socioeconomic impacts of this proposed action would be expected to be small. There would be no discernible impact to employment levels within Benton and Franklin counties. The proposed action would use existing operating and some construction personnel to perform LLBG modifications on the Hanford Site; therefore, the proposed action would have little, if any, socioeconomic impacts.

## 5.3 ENVIRONMENTAL JUSTICE IMPACTS

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", requires that federal agencies identify and address, as appropriate, disproportionately high and adverse human health or socioeconomic effects of their programs and activities on minority and low-income populations. Minority populations and low income populations are present near the Hanford Site (PNNL-6415). The analysis of the impacts in this EA indicates that there would be minimal impacts to both the offsite population and potential workforce by implementing the proposed action. The offsite health impacts from the proposed action analyzed in this EA are expected to be minimal. Therefore, it is not expected that there would be any disproportionately high and adverse impacts to any minority or low-income portion of the community.

## 5.4 CUMULATIVE IMPACTS

In analyzing the impacts of the proposed action, increased radioactive dose, potential toxicological exposures, and potential accident scenarios to personnel would occur temporarily during the retrieval of TRU waste containers. The proposed action is sited in LLBG designed to contain radioactively contaminated materials and conduct remote handling operations. Potential air releases from insertion of HEPA filtered venting devices would be very minor and temporary. Once vented, all TRU waste drum emissions would be captured by the HEPA filter, or a similar device. The potential unabated air releases from the proposed action as described in the NOC is 0.063 mrem, which would be less than the total Hanford Site releases to the air of 0.095 mrem reported in 2000 (DOE/RL-2001-32).

All nonhazardous solid waste and hazardous or dangerous waste would be generated in small quantities, easily handled by existing storage or disposal methods on the Hanford Site.

Because the proposed action would involve existing operations and construction personnel and a small crew of temporary assay and venting personnel, little or no change is expected in the overall workforce on the Hanford Site or within Benton and Franklin counties. Operations within the LLBG would be modified slightly, but change little because of the proposed action. There would be no adverse socioeconomic

impacts or any disproportionately high and adverse impacts to any minority or low-income portion of the community.

Because there are no substantial, foreseeable adverse impacts from this proposed action, there would be no substantial addition to Hanford Site cumulative impacts.

## **5.5 IMPACTS FROM ALTERNATIVES**

Alternatives and the No Action Alternative are discussed in the following sections.

### **5.5.1 Impacts of the No Action Alternative**

The No Action Alternative would involve leaving the TRU waste in the LLBG in its current state, for now. This would result in little to no change in existing short-term conditions within the LLBG. The potential long-term impacts of the No Action Alternative for this EA is the same as the potential impacts of the No Action Alternative as analyzed in Section 5.5.4 of DOE/EIS-0113, and the long-term analysis is not repeated here.

### **5.5.2 Impacts of Alternative to Retrieve Post-1970, Suspect CH-TRU Waste from the 218-W-4B and 218-W-4C LLBG**

The alternative to retrieve all post-1970 suspect CH-TRU waste from the 218-W-4B AND 218-W-4C LLBG, including the boxes, casks, and other large containers and RH containers was not analyzed in detail. The impacts of this alternative would be a higher potential for personnel exposure due to more movements of waste containers. The impacts would include substantially greater cost due to the need to develop a storage facility capable of storing the large and RH waste containers until they can be processed in the future. This alternative may be considered at a future time, when it aligns with treatment and processing capacity for the large and RH waste.